What is claimed is:

1. A method of manufacturing a semiconductor device, the method comprising:

forming a first dielectric layer on a substrate;

forming a first patterned conductive layer having gaps on the first dielectric layer, the first patterned conductive layer comprising a first conductive feature having an upper surface and side surfaces;

depositing a dielectric gap fill layer to fill the gaps;

depositing a second dielectric layer on the first patterned conductive layer and on the gap fill layer;

forming a photoresist mask on the second dielectric layer;

forming a through-hole in the second dielectric layer exposing the upper surface of the first conductive feature; and

removing the photoresist mask and cleaning the through-hole with a plasma containing carbon tetrafluoride (CF_4) and water vapor (H_2O), wherein the as-deposited gap fill layer and/or the second dielectric layer have a dielectric constant no greater than about 3.

2. The method according to claim 1, wherein the gap fill layer and/or the second dielectric layer have an as-deposited dielectric constant of about 1.8 to about 3.

3. The method according to claim 1, wherein the gap fill layer and/or the second dielectric layer comprise hydrogen silsesquioxane (HSQ).

4. The method according to claim 1, comprising removing the photoresist mask and cleaning the through-hole such that the dielectric constant of the gap fill

layer and/or second dielectric layer does not increase more than about 15%.

5. The method according to claim 1, comprising removing the photoresist mask and cleaning the through-hole such that the dielectric constant of the gap fill layer and/or second dielectric layer does not increase more than about 10%.

6. The method according to claim 3, comprising removing the photoresist mask and cleaning the through-hole such that the number of Si-H bonds in the as-deposited HSQ gap fill layer and/or second dielectric layer is not reduced below about 60% to about 80%.

7. The method according to claim 6, comprising removing the photoresist mask and cleaning the through-hole such that the number of Si-H bonds in the HSQ gap fill layer or second dielectric layer is not reduced below about 70% of the Si-H bonds in the as-deposited HSQ gap fill or second dielectric layer.

8. The method according to claim 7, wherein the HSQ gap fill layer and/or second dielectric layer have a dielectric constant of about 3.1 to about 3.3 after removing the photoresist mask and cleaning the through-hole.

9. The method according to claim 1, comprising removing the photoresist mask at a rate of about 10 to about 20KÅ/min.

10. The method according to claim 9, comprising removing the photoresist mask and cleaning the through-hole at a:

temperature of about 190°C to about 290°C;

RF power of about 800w to about 1,200W;

pressure of about 960 to about 1,440 mTorr;

an H_2O flow rate of about 240 to about 360 sccm; and

a CF_4 flow rate of about 30 to about 60 sccm.

11. The method according to claim 10, comprising removing the photoresist mask for about 20 to about 60 seconds.

12. The method according to claim 1, comprising forming the through-hole in the second dielectric layer exposing a portion of the upper surface and at least a portion of a side surface of the first conductive feature and penetrating into and exposing a portion of the gap fill layer.

13. The method according to claim 12, comprising filling the through-hole with conductive material to form a borderless via.

14. A method of manufacturing a semiconductor device, the method comprising:

depositing a layer of dielectric material, having an as-deposited dielectric constant no greater than about 3, over a conductive region or conductive feature;

forming a through-hole in the dielectric layer exposing the upper surface of the conductive region or conductive feature; and

removing the photoresist mask and cleaning the through-hole with a plasma containing carbon tetrafluoride (CF_4) and water vapor (H_2O).

15. The method according to claim 14, comprising removing the photoresist mask and cleaning the through-hole such that the dielectric constant of the dielectric layer does not increase more than about 15%.

16. The method according to claim 14, wherein the dielectric material comprises hydrogen silsesquioxane (HSQ).

17. The method according to claim 16, comprising removing the photoresist mask and cleaning the through-hole such that the number of Si-H bonds in the as-deposited HSQ dielectric layer is not reduced below about 70%.

18. The method according to claim 17, wherein the HSQ dielectric layer has a dielectric constant of about 3.1 to about 3.3 after removing the photoresist mask and cleaning the through-hole.

19. The method according to claim 14, comprising removing the photoresist mask as a rate of about 10 to about 20KÅ/min.

20. The method according to claim 19, comprising removing the photoresist mask with a water vapor plasma:

at a temperature of about 190°C to about 290°C;

at an RF power of about 800W to about 1,200W;

at a pressure of about 960 to about 1,440 mTorr;

at an H_2O flow rate of about 240 to about 360 sccm; and

at a CF_4 flow rate of about 30 to about 60 sccm;

for about 20 to about 60 seconds.